

# Natural Heritage Resources Fact Sheet

## Karst Resources of the New River Basin

Despite its name, the "New River" is among the world's oldest. The origin of the name is uncertain, but it was probably so named when European settlers came upon a peculiar river flowing toward the continent's interior rather than the Atlantic. From its headwaters in the Blue Ridge Mountains near Boone, N.C., the New River follows a meandering route northward across western Virginia to its confluence with the smaller Gauley River in southern West Virginia. There it takes the name Kanawha and flows to the northwest, emptying into the Ohio River at Point Pleasant, W. Va. The New-Kanawha watershed covers 7,500 square miles of Virginia, North Carolina and West Virginia. About 7.5 percent of Virginia (3,070 square miles) lies within the New River watershed, with 250,000 Virginians distributed among 37 tributary watersheds.

The New River begins its journey in the mountains of North Carolina, in ancient metamorphic and igneous rocks, which comprise the core of the Blue Ridge Mountains. These rocks were transported westward to their current position along a fault system that runs along the northwest margin of the Blue Ridge Mountain range. The New River crosses this fault system in northwestern Carroll County, and for the remainder of its journey through Virginia flows across the folded and faulted sedimentary bedrock of the Valley and Ridge province.

This sedimentary bedrock consists of three primary rock types: sandstone, shale, and carbonate rock. Weathering forces act on this bedrock to produce the landscapes of the New River watershed. The sandstone is well cemented and resistant to weathering and forms ridges. Shale and carbonate rock, which are relatively soft and soluble, underlie the valleys. In addition, carbonate rocks weather readily by dissolution, and thus form *karst*.

Precipitation that does not run off, evaporate, or nurture plants, enters the underlying soil and rock and becomes groundwater. In most landscapes, groundwater moves slowly, either through the tiny spaces between mineral grains or along tight fractures. In karst, on the other hand, groundwa-

ter moves relatively quickly through an interconnected system of channels in the bedrock. In fact, it is the groundwater itself that forms karst by dissolving carbonate bedrock, either limestone or dolomite. The weakly acidic groundwater dissolves the carbonate rock along the fractures through which it moves, and over thousands of years forms karst topography. Characteristic features of karst include caves, sinking streams that disappear into holes in the bedrock, and sinkholes formed by collapse of subsurface voids. Karst landscapes frequently lack surface streams since the water flow is through underground streams that emerge from karst springs that emit large volumes of water rich in dissolved minerals.

Northwest of Grayson, Carroll and Floyd counties, karst underlies 50 percent or more of the watershed and an even larger proportion of the valley floors where population and development are concentrated. Here most rural households and many municipal water supplies rely on karst groundwater from wells or springs. Native American and early European settlements concentrated around large volume karst springs that delivered cool, clear water year-round. Millions of gallons of karst groundwater flowing from springs constantly replenish the New River and sustain surface water levels during drought conditions.

### Karst Biological Communities

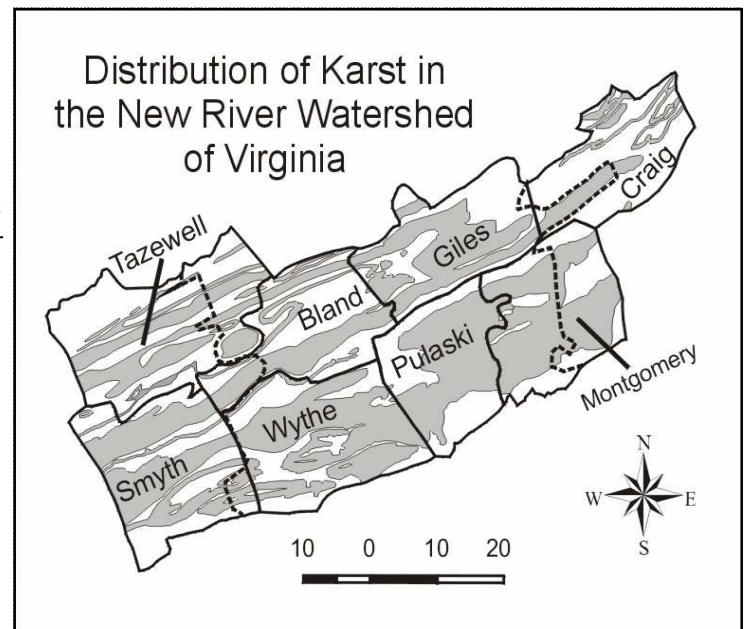
Caves are distributed throughout the karst of the New River watershed and represent a portion of the "plumbing" of the karst groundwater system. At least 31 rare species have been catalogued within the caves of the New River watershed. Cave organisms include bats, the Alleghany wood rat, and dozens of specialized invertebrates that

live only within caves. Aquatic cave species are sensitive to groundwater contamination, thus monitoring their populations helps scientists detect groundwater contamination. Caves are protected by the Virginia Cave Protection Act, which prohibits anyone from vandalizing cave formations or artifacts, polluting caves or disturbing cave organisms. Calcium-rich water seeping from springs can create small wetland communities on the surface that harbor rare and unusual plant species.

Among the interesting natural communities found on karst are dolomite and/or limestone barrens which generally occur on steep, south- and southwest-facing slopes underlain by dolomite or limestone bedrock. Dolomite differs from limestone in that much of the calcium of limestone has been replaced by magnesium. Barrens vegetation, which thrives on the magnesium-rich substrate, is characterized by eastern red-cedar, chinquapin oak, and a rich assortment of drought tolerant grasses, other herbs and shrubs. Many rare plants can be found on this habitat.

### Other Karst Resource Benefits

Caves and karst also preserve important clues about the past for geologists, paleontologists and archaeologists. The rock itself contains marine fossils that tell when and in



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what ancient environment it was laid down. Remains of Ice Age creatures such as mammoths and giant sloths were washed into or trapped in caves of the New River watershed. Radiometric dating of river cobbles and sediments deposited by the ancestral New River has helped geologists determine how fast the river is downcutting.

Archaeologists have pieced together ideas about the cultures of past peoples based on clues in the form of tools, writings and human skeletons. In early American history, many caves were mined for saltpeter, a nitrate compound in the clay mud, which was combined with sulfur and charcoal to make gunpowder. Saltpeter was mined most heavily during the American Revolution (1775-1778), the War of 1812 and the Civil War (1861-1865).

### Karst Resources and Water Quality

The intimate connection between surface water and groundwater in karst makes for an environment that is easily contaminated. In most non-karst settings, surface water slowly percolates into the ground, allowing time for filtration and natural bio-remediation, such as the uptake of nitrates by plants. In karst, on the other hand, voids and conduits allow surface water to enter groundwater quickly, often without ample time for filtration or biological breakdown of nutrients and contaminants. Consequently what takes place on the surface largely determines the nature and proportions of contaminants that enter karst waters.

In the New River watershed three classes of land use dominate: forest, agricultural, and urban. Forests cover approximately 58 percent of the watershed, concentrated along ridge-tops and slopes. Much of the forested land in the watershed lies up-slope from the karst. Forest streams commonly sink into the sub-surface shortly after flowing onto karst. Streams that drain mature forest areas are generally very clean except for occasional low-level bacterial contamination from wildlife. However, logging operations may

increase erosion and runoff, potentially producing large volumes of soil and organic debris, or result in accidentally spilled fuel or other contaminants, thus forest best management practices (BMPs) are essential.

Agricultural land, mostly pasture, crop and orchard land, covers 37 percent of the New River watershed. Agriculture is a significant potential source of water quality degradation in the watershed. Fertilizer, pesticides and manure drain from cropland, active livestock areas and pastures into streams and sinkholes.

Disposal of wastes in sinkholes, once a common practice, is illegal and directly impacts karst. Implementation of agricultural BMPs, as specified by Virginia's soil and water conservation districts, can greatly reduce the potential impacts of agriculture on both surface water quality and karst resources.

Urban and residential land use, though accounting for only about four percent of

the watershed, can result in significant surface and groundwater degradation. Examples of chemical contaminants commonly released include petroleum, antifreeze, and runoff from parking lots and roads, fertilizer and pesticides from landscaping activities and termite treatments, sediment from construction sites, chemical spills and leaking underground storage tanks. Bacterial and chemical contamination from leaking sewer lines or malfunctioning septic systems can further degrade water quality and is difficult to detect because these structures are buried.

The identification and protection of sensitive karst areas through appropriate land use planning helps ensure a safe, clean water supply for everyone. These actions also protect rare species and natural communities for the benefit of all. The DCR Karst Program as well as the governor-appointed Virginia Cave Board assist state and federal agencies, local governments, private organizations, and individuals in matters relating to the management of caves and the protection of karst resources in the Commonwealth.

